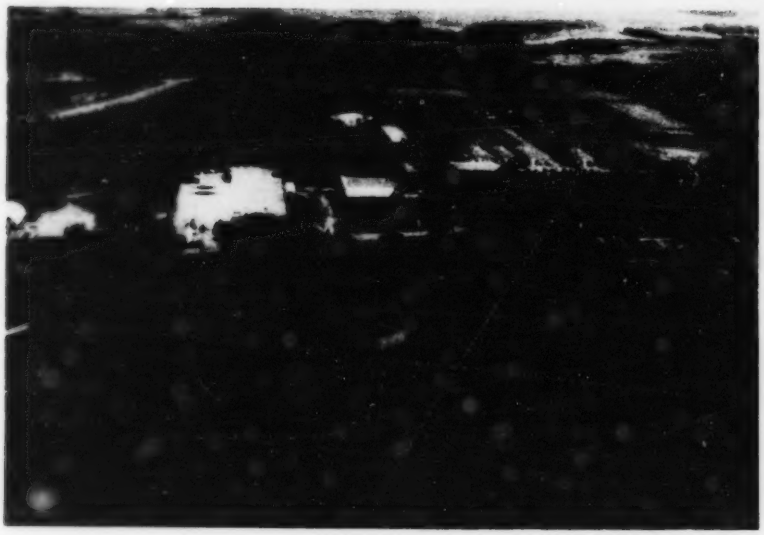
1989
ANNUAL
REPORT

ALBERTA TREE NURSERY AND HORTICULTURE CENTRE



Alberta
AGRICULTURE

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FOR DETAILED INFORMATION CONSULT THE SPECIALIST

DIRECTOR'S REPORT

The last year of the 1980's can be characterized as a year of refining and concentrating resources. Rising costs continued to be an important factor for re-evaluation; programs were reviewed and further streamlined.

Private sector involvement in seed potato and shelterbelt stock production are continually encouraged. Nuclear seed potato production is being jointly developed with three growers with the outlook for total private production by 1995.

Considerable extension efforts, especially in the vegetable and seed potato programs, were directed towards the training of newer growers. General Horticulture Extension staff provided a quality service to their clients through courses and by training commercial outlet operators to provide a sound and factual advice to their customers.

Research projects continued to generate excellent information for better commercial production. Staff at the Centre published research articles in prestigious scientific journals and wrote many popular articles on topics revelant to Alberta growers.

The Centre continued its responsibility of producing, for Alberta producers, shelterbelt and field windbreak plant materials. The Canada Alberta Soil Conservation Initiative (CASCI), aimed at reducing soil erosion added resources to this program at the Centre. The Centre will produce and distribute a large number of field windbreak trees to farmers at no cost except for an application fee of $25.00. Trees of six cultivars were made available immediately and, in 1991, trees of seven cultivars will be available for field windbreak purposes.

In addition to various other responsibilities, the Centre staff made important contributions to a number of industry and government committees and conferences.

Our thanks to the editor of this Annual Report, Dr. Piara Bains. He has put together an excellent collection of reports outlining the progress of the Centre in 1989.

George Grainger
Director
The Alberta Tree Nursery &
Horticulture Centre

1989 SUMMARY

The Centre continued providing leadership to the horticulture industry and coordinated very effectively with many of its commodity groups. These groups included Alberta Greenhouse Growers Association, Alberta Market Gardeners Association, the Alberta Seed Potato group, Fruit Growers Society of Alberta and several groups within the Landscape Alberta Nursery Trades Association umbrella.

The Centre also cooperated with several government branches, divisions and departments. Cooperative projects were conducted with Crop Protection Branch, Soils Branch, Alberta Special Crops and Horticulture Research Centre, 4-H Branch, Market Development Branch, Alberta Environmental Centre, Alberta Fish and Wildlife, Alberta Forest Services and Alberta Transportation.

Many research and product testing projects were commenced in 1989. These projects were conducted in cooperation with the University of Alberta, Humate of Canada Limited, Can-Green services, Austre Limited, Cub-Resources Limited and both urban and rural public. Some of these groups provided funds for research and product testing.

Protected Crop Development

This section is involved in research and development for the greenhouse, small fruit and more recently tree seedling industry. The developmental aspects included extension, technology transfer, diagnostics and information generation. Major contributions during 1989:

- maintained an effective level of technology transfer through individual grower visits, workshops, open houses, courses and newsletters;
- researched on the use of potassium as a nutrient for cucumbers and information made available to growers resulting in increased production;
- continued the developmental work on bio-control of root-rot caused by Pythium in hydroponic systems;

- taught a course on greenhouse management at the University of Alberta fulfilling a part of our commitment to the betterment of the greenhouse industry;
- continued micropropagation of saskatoons and other plants. Five thousand genetically pure saskatoon plants were provided to the Fruit Growers Society of Alberta.

Nursery Crop Development

On May 28th, 1989, frost injured growth on ash, walnut and oak. Twenty five percent of ash were killed in seedbeds. The frost also injured other blossoms.

Plant orders for 1990 were 30% higher than that of 1989 (1,130,000 in 1990 to 866,000 in 1989). Out of these, 456,000 plants were provided free under the field windbreak program. Northwest poplar, green ash, caragana, dogwood and white spruce were made available for 1990 distribution under the free field windbreak program, acute leaf willow will be added to this list for 1991 distribution. Poor recovery of stooling beds from 1987 frost have caused shortages in northwest and griffin poplars.

In 1989, 1,005,325 plants were distributed including 43,600 seedlings for arbor day.

Regional Woody Plant Rest Program is now in its seventh year. Prairie Regional Trial for Woody Ornamentals and All-American Selections Annual Flower Trial were initiated. The Austre willow grew 9 1/2 feet by September but was killed to the ground by early frosts.

Four issues of Nursery Notes was produced.

Horticulture Crop Development

Excellent results were obtained from research programs on Rhizoctonia disease of potatoes, studies on phytotoxins produced by Alternaria spp., and improved micropropagation technique for seed potatoes.

Extension programs in vegetable production encouraged people to become vegetable growers and the program further helped them to get established in the industry. Research trials were successfuly re-established and growers have shown confidence in recommendations generated from the results.

The master gardener program has been planned. Horticulture extension via telephone inquiries continues to gain credibility and popularity.

The Alberta seed potato industry is expanding continually and has grown into a $9M industry. Grower confidence in this program is at an all time high. Recent trend of participation in the production of nuclear and pre-elite seed is proving to be very successful.

ADMINISTRATION

Alberta Tree Nursery and Horticulture Centre Staff - 1989

George Grainger	Director

Administration Section:

Linda Hansen	Office Manager
Michele Dannish	Branch Secretary
Shelley Draper	Word Processor Operator
Helen Rekrut	Administrative Secretary
Pat Fulton	Receptionist
Vicki Noel	Courier

Changes in the Administration Section included Helen assuming duties of Administrative Secretary and Pat Fulton taking over the receptionist duties in November 1988. In mid-1989 Pat Fowler left and Linda Hansen commenced as Office Manager.

Horticulture Crop Development Section:

James Letal	Head, Horticulture Crop Development
Dr. Piara Bains	Micropropagation Pathologist

Vegetable Section:

Belinda Choban	Vegetable Crop Specialist
Dominique Bizon	Vegetable Technician

Horticulture Extension:

Betty Vladicka	Horticulture Extension Specialist
Pam North	Horticulture Information Officer

Seed Potato Production:

Bruce Chedzoy	Seed Potato Production Technician

Changes and expansion of the Seed Potato Program necessitated the move of Bruce Chedzoy from Farm Operations Section to Seed Potato Production within the Horticulture Crop Development Section.

Protected Crop Development:

Dr. Mirza Mohyuddin	Head, Protected Crop Development
Kris Pruski	Tissue Culture Specialist
Muhammad Younus	Lab Technician

Nursery Crop Development Section:

Brendan Casement	Head, Nursery Crop Development

Shelterbelt Production:

Brian Breneman	Shelterbelt Production Specialist
Rulie Bok	Gardener
Patricia Elliott	Gardener
Rosie Pullishy	Gardener
Vera Fialkowski	Gardener
Simone Dalpe	Lab Technician

Arboretum and Grounds:

Thean Pheh	Woody Plant Research Technician
Henry Brown	Gardener

Container Production:

Cecilia McIsaac	Container Technologist
Sophie Eckberg	Gardener

Seed Orchards:

Nancy Moroz	Gardener

Chemicals and Seedlings:

Doug Lehman	Chemical Applicator

Staff in the Nursery Crop Development Section said farewell to Doreen Koladich who is pursuing her career in motherhood. Joan Sumka, who had been with the Centre since 1972, is wished a happy retirement. Rosie Pullishy joined us in an offset position after Pat Elliott was injured in an accident on the job.

Farm Operations Section:

Al Faulkner	Farm Services Supervisor
Dave Wearmouth	Farm Services Foreman
Kevin Thorpe	Gardener
Paul Gervais	Auto Mechanic
Stan Bootsma	Auto Mechanic
Gerhard Dames	Welder
Brian Petherbridge	Maintenace Service Worker
Steve Milne	Maintenace Worker, Irrigation

Another good wish for retirement from the Centre is for Cyril Cooreman. He had been with us since 1972. A welcomed change was Kevin Thorpe's move from the Chemical area to Farm Operations. A back injury has forced Paul Gervais to be on Worker's Compensation.

Alberta Tree Nursery & Horticulture Centre Staff - 1989

George Grainger
Senior Manager
/Director

Administration Section

Linda Hansen
Office Manager

Michele Dannish
Branch Secretary

Shelley Draper
Word Processor

Vicki Noel
Courier

Helen Rekrut
Administrative
Secretary

Patsy Fulton
Receptionist

Horticulture Crop Development

James Letal
Head, Horticulture
Crop Development

Piara Bains
Micropropagation
Pathologist

Betty Vladicka
Extension
Horticulturist

Pam North
Horticulture
Information Officer

Belinda Choban
Vegetable Crop
Extension

Dominique Bizon
Lab Technician

Bruce Chedzoy
Seed Potato
Production
Assistant

Nursery Crop Development

Brendan Casement
Head, Nursery Crop
Development

Shelterbelt Production

Brian Breneman
Shelterbelt
Production
Specialist

Thean Pheh
Gardener,
Shelterbelt
Research

Simone Dalpe
Lab Technician,
Fruit & Shelterbelt
Research

Rulie Bok
Gardener

Henry Brown
Gardener

Vera Fialkowski
Gardener

Container Program

Cecilia McIsaac
Technologist

Joan Sumka
Gardener

Sophie Eckberg
Gardener

Seed Section

Doreen Koladich
Seed Section
Supervisor

Nancy Moroz
Gardener

Chemical Section

Doug Lehman
Chemical Applicator

Protected Crop Development Section

Mirza Mohyuddin
Head, Protected
Crops Development

Kris Pruski
Tissue Culture
Specialist

Muhammad Younus
Lab Technician

Farm Services

Albert Faulkner
Farm Services
Supervisor

Dave Wearmouth
Farm Services
Foreman

Dave "Steve" Milne
Maintenance
Worker, Irrigation

Kevin Thorpe
Gardener

Gerhard Dames
Welder

Cyril Cooreman
Field Cultivation

Paul Gervais
Auto Mechanic

Stan Bootsma
Auto Mechanic

Brian Petherbridge
Maintenance
Service Worker

HORTICULTURE CROP DEVELOPMENT

The Horticulture Crop Development Section consists of four programs: Seed Potatoes, Vegetable, Micropropagation Pathology and Horticulture Extension. Presently, we are operating with five permanent, one temporary salary and a number of temporary staff members.

Seed Potato Program - Jim Letal

The Seed Potato Program continued to produce "disease-free" seed potatoes as well as provide research and extension programs for Alberta seed producers. Primary responsibility for this program lies with Jim Letal. Dr. Piara Bains is responsible for the plant pathology work. Kris Pruski of the Protected Crops group is responsible for tissue culturing and Bruce Chedzoy is responsible for greenhouse and field production. Occasionally, we obtain labor assistance from the Nursery production crew.

In 1988 we made a commitment to the Alberta Seed Potato Growers Association to produce a large quantity of Elite I seed potatoes. We produced 45,630 kilograms of seed that was sold to Case Spelt on advice from the Seed Potato Growers Association. Case Spelt will subsequently produce seed of future generations that will be available to other growers in 1990.

In addition to Case Spelt, three other growers are working towards Elite seed production. These operations purchased Nuclear and Pre-elite seed from Alberta Agriculture and grew it for continual sale to other seed producers. One of these three growers also purchased tissue cultured plantlets from the Program and grew them in his greenhouse to produce nuclear seed. Another grower is constructing a greenhouse and laboratory with the intent of producing his own Nuclear seed. As these grower operations come on-stream we will reduce our production. We anticipate that within four years we will terminate field production of

Pre-elite seed, and our greenhouse production will depend upon the quality of seed produced by the grower operations.

Alberta seed potato growers' production and export sales continued to increase (table I and figure 1). In 1988, 17,223 tonnes of seed potato were exported to Washington, Oregon, Idaho, North Dakota, and California. Breakdown of exports by variety was as follows:

76.4% were Russet Burbanks
12.9% were Shepody
4.0% were Norchip
3.8% were Atlantic
1.3% were Sangre
1.6% were other (Conestoga, Kennebec, Norland, Superior and Yukon Gold)

In the spring of 1989 Alberta Agriculture sold 68,372 Nuclear and Pre-elite, seed potato tubers to 21 growers in Alberta. The remainder of our nuclear seed was planted in a field near Bruderheim to produce Pre-elite and Elite I seed potatoes. The seed produced in the field, and the Nuclear greenhouse tubers, will be available to growers in the spring of 1990. For varieties and quantities of seed available see table II.

In 1989, we produced 86,819 Nuclear and 67,329 Pre-elite seed potato tubers in the greenhouse and 24,000 kg of Elite I seed potatoes in the field.

Seed production by producers was less than that of last year. A total production of 43,473 tonnes was down by 2,500 tonnes. The main reasons were lower yields and frost damage that occurred in the late fall before the harvest was complete. Lower yield subsequently resulted in higher seed potato prices.

Table I. Alberta Seed Potato Production and Exports - 1965-1988

Crop Year	Number of Seed Growers	Seed Area (hectares)	Production (tonnes)	Exports (tonnes)
1965	59	1,033	16,773	265
1966	61	1,363	27,273	1,720
1967	53	1,220	18,636	145
1968	50	1,065	25,318	960
1969	42	1,165	17,591	1,992
1970	46	1,202	26,409	591
1971	45	1,216	18,091	185
1972	32	943	15,455	175
1973	26	672	13,091	1,530
1974	23	669	12,727	1,395
1975	24	620	12,000	2,200
1976	18	222	4,636	0
1977	16	512	6,909	78
1978	13	561	9,955	210
1979	14	466	10,455	414
1980	15	483	13,455	3,258
1981	19	593	13,273	3,630
1982	18	739	14,136	4,249
1983	23	971	21,818	6,228
1984	33	1,295	22,500	9,514
1985	37	1,675	30,310	10,488
1986	37	1,792	36,838	11,258
1987	35	1,619	45,000	14,289
1988	32	1,644	46,057	17,223
1989	32	1,845	43,473	

FIGURE 1.

SEED POTATO PRODUCTION AND EXPORTS

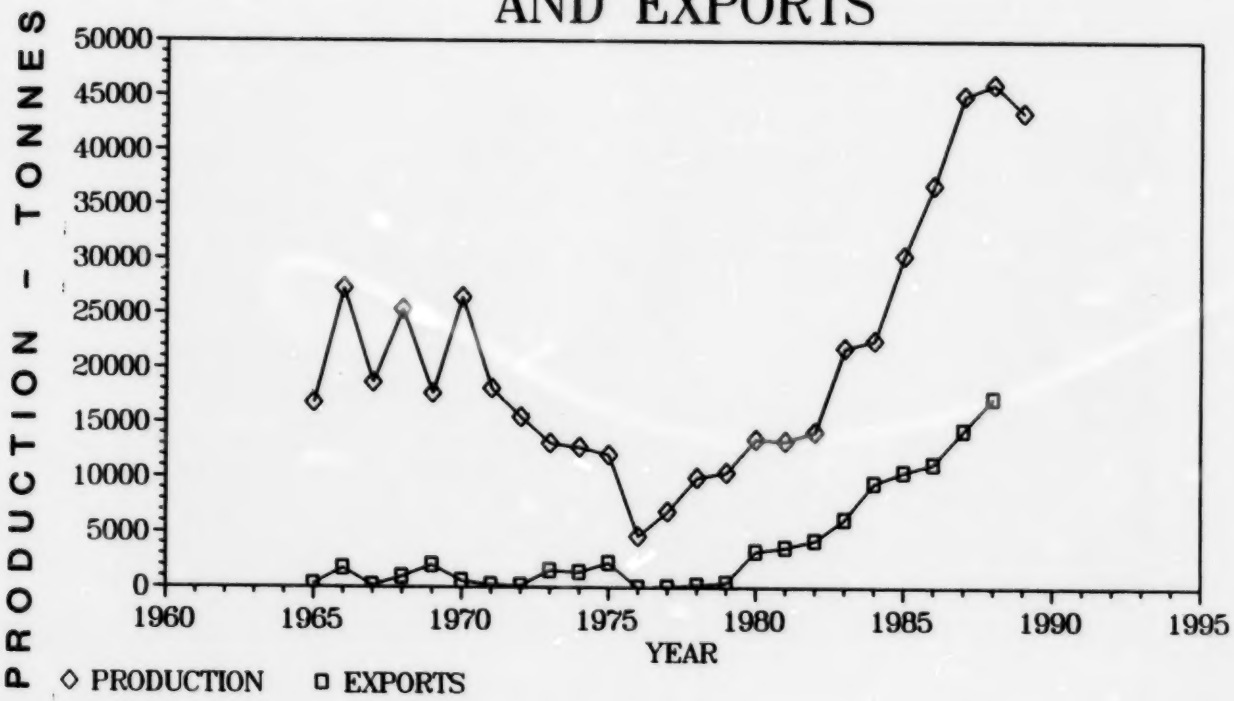


Table II. 1989 Seed Potato Production

	Nuclear (tubers)	Pre-elite (tubers)	Elite I (kg)
A69868-2	1,013	830	--
A74117-9	38	--	--
Atlantic	5,107	--	--
Banana	71	350	--
Batoche	32	100	--
Bintje	118	--	--
Caribe	129	--	--
Carlton	195	20	2,000
Cherokee	95	--	--
Conestoga	5,078	450	--
Eramosa	844	--	--
F72004	51	--	--
F76080	36	90	--
Jemseg	77	30	--
Kennebec	95	100	--
Min 9632	1,298	1,600	--
Monona	1,845	600	--
Norchip	6,920	4,900	--
Norgold Russet	99	160	--
Norland	3,183	220	3,000
Red Pontiac	177	6	--
Russet Burbank	35,614	54,100	13,000
Russet Norkotah	3,907	1,300	6,000
Sangre	7,001	690	--
Shepody	10,090	--	--
Superior	993	580	--
Viking	207	15	--
Warba	127	800	--
Wisc 848	1,813	8	--
Wisc 74-7	32	--	--
Yukon Gold	534	360	--
Totals	86,819	67,329	24,000

Figure 2. Nuclear seed potato planting.

Figure 3. Disease roughing of Nuclear seed potato field.

Horticulture Extension Program - B. Vladicka, P. North

The mandate of this program is to support and foster the development and growth of the horticultural industry in Alberta. This is achieved by providing sound and accurate information to the general public and the horticultural service industry; and by serving as a liaison between Alberta Tree Nursery and Horticulture Centre, public institutions, and the general public. The activities focussed on education and technology transfer using a variety of methods.

The regional courses continued to be offered through the district offices to Field Services. Between February and mid April, approximately 485 people attended sixteen courses offered across the province. The three most popular courses were farmstead planning, backyard orchards and hobby greenhouses. Extension staff were also asked to speak at several farm women's conferences, and an inservice for regional staff.

Because of the interest generated by a presentation on insects and diseases of ornamentals to the retailers commodity group of LANTA, extension staff conducted two diagnostic workshops for the group. The workshops, held in Calgary and Edmonton, were well attended. Because this segment of the industry provides consumers with considerable advice, there is much concern about the quality of this advice. The purpose of these workshops was to provide additional training to staff to ensure that they were providing accurate advice.

Staff also participated in a workshop on park maintenance organized by Alberta Recreation and Parks. This is the second year of our involvement with this department and it provides an excellent opportunity to interact with a different group of clients.

Several municipalities across the province provide horticultural information services to the residents. To assist these municipal employees, the extension staff conducted a two-day workshop on

diagnosing chemical damage on horticultural crops and continued producing a newsletter, Horticulture Extension Notes, providing information on current problems, plant descriptions and other pertinent subjects. A grant program administered by this office provides funds to the municipalities to assist in offsetting the operational costs of providing the information service.

Horticulture extension provided information directly to the general public in a number of ways. In addition to the telephone inquiries and the hortline (a taped telephone message), a very basic diagnostic service was provided. See table I for 1989 statistics. While inquiries varied considerably, certain problems were more prevalent. The winter desiccation injury on woody ornamentals was province wide and moist conditions this year caused an increase in the incidence of fireblight.

Mass media channels continued to be utilized wherever the opportunity arose. Provided interviews for Call of the Land and several radio stations across the province; appeared as guests on phone-in radio programs and submitted articles to Agri News, several monthly magazines and an industry magazine. The Extension Horticulturist coordinated the revision of the popular publication, the Alberta Horticulture Guide.

In addition to the extension functions, the Extension Horticulturist sits on the executive of several organizations. She is an ex-officio director of the Alberta Horticultural Association and was actively involved with its several committees. She served as the coordinator of their education program and editor of their quarterly newsletter, the Alberta Horticulturist. The Extension Horticulturist was elected President of the Friends of the University of Alberta Devonian Botanic Garden. She is also member of the University's Advisory Committee to the Vice President (Research) regarding the Botanic Garden. In 1989 she was also elected President of the Western Canadian Society of Horticulture, a body of professional horticulturists from the three levels of government, colleges, universities and industry across the Prairies.

Table I. Extension Statistics for 1989.

	INQUIRIES	HORT CALLS	SOIL REPORTS	PUBLICATIONS	OFFICE VISITS	PLANT SAMPLES
January	100	153	1	550	3	1
February	145	156	0	2,085	3	--
March	135	162	1	4,730	4	1
April	595	253	28	2,890	10	3
May	950	431	91	1,350	14	31
June	825	262	46	1,080	23	40
July	525	423	--	4,350	18	23
August	775	365	40	1,800	30	57
September	615	312	86	1,565	15	22
October	370	236	17	1,280	5	7
November	130	176	40	605	3	3
December	70	132	29	80	3	--
TOTAL	5,235	3,061	379	22,365	131	188

Micropropagation Pathology - **Piara Bains**

The Micropropagation Pathology Program includes research projects and disease indexing of nuclear seed potato plants.

Black scurf and stem canker caused by Rhizoctonia solani is a serious and wide spread disease of potatoes. The project was started to identify anastomosis group affinities and relative pathogenicities of different field isolates of the fungus, and to evaluate the efficacy of selected fungicides and/or microbial antagonists and hyperparasites against the fungus. Sixty five isolates of R. solani isolates were collected from potatoes grown in central and southern Alberta. Studies on anastomosis group affinity of R. solani isolates suggested that majority of these isolates belonged to anastomosis group-3 (AG-3), the most prevalent group found on potato. However, some isolates did anastomose with tester isolates other than AG-3. Anastomosis group affinity provides valuable clues regarding pathogenicity and virulence of R. solani isolates.

During this year a research project was initiated to develop a simpler method for potato micropropagation. The preliminary results obtained so far are very encouraging and the method is now being fine tuned for optimal conditions.

Two research projects dealing with toxins produced by Alternaira brassicae, causal agent of blackspot of canola, yielded valuable results: Homodestruxin B, a metabolite produced by the fungus was identified to be a toxin. Further studies on its biological characterization revealed that the toxin is a nonhost-specific, therefore, a virulence not a pathogenicity factor. These results fit in snugly with the results of a previous study which indicated that the fungus produces destruxin B, a host-specific toxin and a pathogenicity factor.

The second project on toxins conducted in cooperation with the Department of Plant Science, University of Alberta, described the

importance of phytoalexins in disease resistance of plants. Leaves of two weed species Camelina sativa and Capsella bursa-pastoris were found to be sensitive to dextruxin B. However, these plants are highly resistant to A. brassicae due to elicitation of phytoalexins. The observations reinforce the importance of phytoalexins in the resistance of these plants to A. brassicae and raise some questions regarding the definition of a host-specific toxin.

Disease indexing aspect of nuclear seed potato program includes testing of about 60,000 greenhouse nuclear plants for potato virus S (PVS) and potato virus X (PVX) by ELISA technique. In addition to this, 300 nuclear mother plants were tested for PVS, PVX, potato leaf roll virus (PLRV) by ELISA, potato spindle tuber viroid by dot blot hybridization and bacterial and fungal pathogens using culturing techniques.

Two banks of about 300 nuclear mother plants are maintained all year round for multiplication of nuclear plants. A regular supply of common virus indicator plants was maintained for virus indexing.

Vegetable Program - B. Choban

The vegetable program at the Alberta Tree Nursery and Horticulture Centre (ATN&HC) includes both applied field research and industry extension activities on production of fresh vegetables. The program serves a growing vegetable industry of more than 300 market gardeners and commercial producers in central and northern Alberta.

Market gardeners experienced excellent sales and production this year. The Alberta Market Gardeners Association (AMGA) conducted extensive advertising to increase consumer awareness and sales of local fresh vegetables. Growers are becoming more responsive to pesticide issues and are lim ng the use of pesticides. The local consumer is beginning to favor direct buying from the producer due to concerns about freshness, nutrition and safety. As a result, market garden production and sales are on the increase.

Adverse weather conditions during the growing season were of greater concern to commercial growers than to the market gardeners. Late spring snow and frost delayed early market crops by about two weeks and caused 15% in losses. Mid to late season crops battled inconsistent summer temperatures, hail, excessive August precipitation, and continuous weed and disease control problems. Production costs were high; yields and selling prices were low. Production of a consistent supply of top quality vegetables was difficult. Highly weather sensitive crops such as lettuce, cauliflower and Chinese vegetables, suffered greater losses. As a result, efforts by the industry to market Chinese vegetables in California were not very successful. The need for an adequate hail and crop insurance policy still exists.

Extension Projects:

Extension activities, covering all aspects of vegetable production, were aimed at commercial growers, market gardeners, industry personnel and commodity groups. Considerable time was spent assisting the

inexperienced growers in producing a marketable product under less than favourable growing conditions.

This year's activities included on-farm extension services (135 farm visits), one-to-one grower communication by telephone (approximately 1,000 calls) and grower visits to the office (130 'walk-ins'). Growers are reached by a bi-monthly newsletter, "Produce Notes", and through notices published in the Alberta Market Gardeners newsletter. Information was also provided through various tours, seminars and courses, including cole crop production, marketing vegetables, weed and insect control, water quality workshop, general problem solving workshop, a protective clothing for chemical use seminar, extension of research trial results through seminars, wholesale buyer and vegetable grower tours, growers' social nights and a growers' field day and barbecue.

Assistance was provided to growers in the assessment of hail damage to crops. Forty growers were assisted with fertility recommendations and 13 growers participated in the equipment demonstration program. Sixty new grower inquiries were handled.

Close liaison with the vegetable industry was maintained through contact with such organizations as the Alberta Special Crops and Horticultural Research Center (ASCHRC) in Brooks, the Alberta Fresh Vegetable Marketing Board (AFVMB), the AMGA, the Northern Fresh For Flavor Foundation (NFFF), the Alberta Vegetable Advisory Committee and Sun Fresh Farms Marketing Co-op. Liaison was further enhanced by regular visits to wholesale produce buyers and farmers' markets, and through regular contact with industry equipment dealers and supply companies.

The vegetable specialist was actively involved in the third annual Alberta Horticultural Congress and the Fresh Vegetable Fall Harvest Festival. She was also a guest speaker at the "North of 60" agriculture conference in Whitehorse, Yukon.

Research Projects:

Research consisted of cultivar evaluations for earliness, yield and quality, and investigations into cultural practices designed to enhance and improve crop production. Details of results of both cultivar and cultural trials are reported in the ATN&HC pamphlet entitled "Vegetable Cultivar and Cultural Trials, Edmonton and Peace River, 1989".

Cultivar Trials:

A trial consisting of 150 cultivars of cabbage, cauliflower, broccoli, carrots and sweet corn was conducted in Edmonton. A smaller trial consisting of 44 cultivars of cabbage and sweet corn was conducted in Peace River with the cooperation of a commercial vegetable producer.

Comparisons were made between direct seeding and transplanting of cole crops; early spring and mid-spring plantings of cabbage and broccoli; early, mid and late spring plantings of cauliflower; and storage quality evaluations of carrots and cabbage after 4 and 6 months in storage. Storage evaluations are being conducted with the cooperation of the ASCHRC in Brooks. Transplants required for the trials were grown by contract. In addition, a potato trial was conducted for the Prairie Regional Potato Program administered by Agriculture Canada in Lethbridge.

Cultural Trials:

Cultural trials include -

1) **Fall and spring planted garlic:**

   The objective of this trial was to determine the optimum of 4 planting dates, 3 planting methods and 3 cultivars of garlic.

2) **Fall and spring seeded vegetables:**

The production of Spanish onion, cooking onion, parsnips, head lettuce and spinach was compared for earliness and yields using fall and spring seeding techniques.

3) **Fall and spring seeded carrots:**

Carrot production was evaluated for earliness, yields and grades using two seeding dates (spring vs. fall) and two bed types (raised vs. flat).

4) **Vegetable fertility trial:**

The production of broccoli, carrot and pickling cucumber was evaluated for yields and quality under several application rates of nitrogen and phosphorus fertilizer.

In addition, the following trial monitoring occurred -

1) **Monitoring of commercial fields for fertility management practices:**

Fourteen commercial crops of broccoli, carrot and pickling cucumber were sampled at various plant growth stages and times of fertilizer application to evaluate plant nutrient uptake, soil fertility levels and crop yields. Data is being analyzed in cooperation with the Soils and Animal Nutrition Laboratory of Alberta Agriculture.

2) **Monitoring of carrot rust fly:**

Damage to local carrot crops in 1988 resembling that caused by the larvae of the carrot rust fly led to this investigation. Three commercial carrot crops were monitored for the flies using sticky yellow traps. All traps were analyzed by Alberta Environment and have showed evidence of carrot rust fly.

3) Cauliflower and broccoli maturity prediction:

Nine cultivars of cauliflower and four of broccoli were evaluated for the number of days required to reach maturity after curd initiation (cauliflower) or spear initiation (broccoli). An attempt was made to relate the days to maturity to accumulated heat units and leaf number during curd or spear growth. The results thus far are inconclusive and further research will be undertaken in 1990.

Figure 1. Vegetable Growers' Tour.

PROTECTED CROP DEVELOPMENT

Greenhouse Program - Commodity Report - M. Mirza

Nineteen eighty nine was an average year for the Alberta Greenhouse Industry. As always, those growers who were aggressive and made use of new technologies and research had higher production. Those growers who were not as aggressive remained behind in gross revenues.

The vegetable sector had its ups and downs. Many growers raised three crops of seedless cucumbers instead of two by switching over to rockwool. This resulted in an excellent production of good quality fruit in June, July and August. The top growers in rockwool obtained yields of 70-75 kg/m^2, while the average was around 40 kg/m^2.

Tomato production was stable. A slight decrease in acreage was observed. A large indoor lettuce and herb production facility was started.

Bedding and ornamental plant growers had a good year. Spring was a little late and a serious frost in late May forced the growers to come up with more plants. Serious pH related problems on poinsettias affected the quality of the crop.

The Alberta Greenhouse Growers Association progressed well during 1989. The Alberta Horticultural Congress was a successful event in Edmonton.

Alberta Agriculture continued to provide an extensive back up to the greenhouse growers. The Soils and Animal Nutrition Laboratory continued to provide soil and water analyses on a priority basis.

The Alberta Greenhouse Industry Assistance Program was announced in 1989. Thirty nine growers took advantage during the year. It was encouraging to note that a large number of growers utilized this program to install computers and reverse osmosis units in the greenhouses.

Many greenhouse growers received beginners contracts from Pine Ridge Nursery to grow tree seedlings. There is a great interest to grow tree seedlings for reforestation.

Greenhouse Extension Program:

During 1989, an excellent level of technology transfer was maintained to greenhouse growers in central and northern Alberta by using the following practices:

1. Visiting growers on the basis of their needs and expertise available. New growers were visited on a regular basis and established growers on a problem basis.

2. Holding subject workshops. During the 1988-89 season, the following workshops were held: the production of cucumbers and tomatoes, greenhouse environmental controls, water quality and management, and tree seedling production in greenhouses. Grower participation was very good.

3. Actively participated in the industry tours. The bedding plant and vegetable tour was fairly successful.

4. Organized growers field days. Alberta Tree Nursery and Horticulture Centre's Field Day was held on July 19, 1989 in which several growers participated.

5. Attended specialized conventions, obtained pertinent information and passed on to the growers. Attended two major conventions: Hydroponic Society of America Convention in Tucson, and Professional Plant Growers Association Conference in Ohio.

6. Participated in Agriculture Canada Greenhouse Open House in Agassiz, B.C. Information obtained was transferred to growers through the Alberta Greenhouse Notes.

7. Maintained a key role in soil and nutrient recommendations. Due to a switch over to non-soil growing media, extensive consultations were required by growers, which were effectively provided.

8. Constantly generated information by participating in greenhouse surveys e.g. industry, economic surveys.

9. Updated publications eg. Hobby Greenhouses in Alberta, Vegetable Production Guide and a hydroponics publication.

10. Alberta Greenhouse Notes continued to be an important tool for information transfer. The readership is over 500 growers all across the world.

11. Several bioassays were conducted for herbicides in water and soil. This capability will be expanded further to provide a quick service to growers.

12. Results of the research on use of silicon by cucumber plants is being used by commercial growers with excellent results.

Greenhouse Research - M. Younus, K.-F. Chang, P. Bains, M. Mirza

Effect of Humate® and Humalite® on Root Growth of Geraniums

Organic matter products Humate and Humalite were evaluated for their root growth promoting activity in geraniums. Both products significantly improved the root growth of geraniums in three different media tested. The rooting was improved when cuttings were grown in a washed silica sand amended with 0.5 g/L Humate or 1 g/L Humalite, a soil based mixture amended with 0.5 g/L Humate or 5-10 g/L Humalite, and a standard soilless medium amended with 1.5 g/L Humate. Higher or lower rates did not improve the root growth. Humate is effective at lower rates and is easier to handle than Humalite.

Effect of Humate® and Humalite® on the Yield of Tomatoes:

Humate and Humalite were evaluated for their effect on the yield of vendor tomatoes. The plants were grown in 14 litres of a soil based medium amended with different rates of Humate and Humalite. The plants grown on the medium amended with 0.1-0.5 g/L Humate or 1-10 g/L Humalite provided slightly higher yields from two clusters than that of the control. Further work is required to determine their yield enhancing effect on long-term tomato crop.

Production of Aster as a Potted Flowering Plant:

Ten different varieties of aster were grown from August 1 to September 30 and evaluated for flowering characteristics. Plants of excellent flowering quality were obtained within 60-90 days of seeding. The quality of plants depended on the varieties rather than seeding dates. Pinching of some varieties significantly increased the number of flowers. Rose Mini Lady appeared to be an outstanding variety for fall flowering. Spidermites and thrips were the two major insect problems and must be controlled at an early stage to produce marketable plants.

Effect of Growth Regulators on Poinsettias:

Growth regulators Bonzi® and Sumagic® significantly reduced the height of Annette Hegg Red poinsettias when applied at a concentration of 10 ppm. Higher rates of Bonzi caused a severe stunting and puckering of leaves. Cycocel at 3,000 ppm gave a good height control.

Effect of Growth Regulators on Begonias:

Growth regulators Bonzi, Sumagic and Cycocel were evaluated for growth reduction of two varieties of begonias. Bonzi at 20 and 50 ppm reduced 79% of the growth. Sumagic was very effective at 5 ppm and growth reduction was dependent on the variety. Cycocel at 500 ppm also significantly reduced the growth. Further studies are required to obtain more useful rates.

Effects of an Antagonistic Bacterium on Pythium spp. Causing Root Rot of Cucumber and Tomato:

Bacillus macerans, a bacterium isolated from the roots and seeds of spinach, was evaluated for its antagonistic effects on Pythium spp. under different cultural conditions. It completely inhibited the formation of sporangia and oospores of P. irregulare in different nutrient solutions. A significant biomass reduction was obtained when it was co-cultured with P. irregulare in potato dextrose broth.

B. macerans significantly reduced the percent of damping off of tomatoes in a soilless growing mixture. In an NFT system, B. macerans minimized the damage to cucumber roots by Pythium and as a result higher yields were obtained. B. macerans has the potential to control root rot of cucumber and tomato crops.

Etiological Study of Wilt of Alstromeria:

Pythium spp., Rhizoctonia spp. and Fusarium oxysporum, isolated from diseased underground portions of Alstromeria were tested for their pathogenicity. Preliminary studies showed that young, wounded tissue of rhizomes were particularly vulnerable to all these fungi. Rhizomes inoculated with Pythium spp. and Rhizoctonia spp. were macerated within one week under moist conditions. However, it took about two weeks for F. oxysporum to develop the symptom of vascular discoloration and subsequent wilting of the plant. This is the first report of root rot and wilt disease of Alstromeria in Canada.

Comparative Pathogenicity of Pythium spp. on Tomato and Cucumber Seedlings:

Twelve Pythium species isolated from various crops were tested for pathogenicity on tomato (cv. Caruso) and cucumbers (cv. Corona) grown in a soilless mix. Pythium ultimum was the most pathogenic to both crops followed by P. irregulare, P. "G"., P. sylvaticum, P. paroecandrum, P. splendens, P. "F", P. "H.S", P. coloratum, while the least virulent ones

included P. aquatile, P. vanterpoolii and P. rostratum. In general, highly virulent species killed the seedlings whereas less virulent species reduced the height and fresh weight of the plants.

Ultrastructure of the Aecial and Pycnial Stages of Lettuce Rust:

The surface markings of spores from the aecial and pycnial stages of lettuce rust organisms were examined using SEM. Based on the morphology of aeciospores and peridia, the organism was identified as Puccinia dioicae magn. This is the first report of the detailed ultrastructural morphology of this fungus.

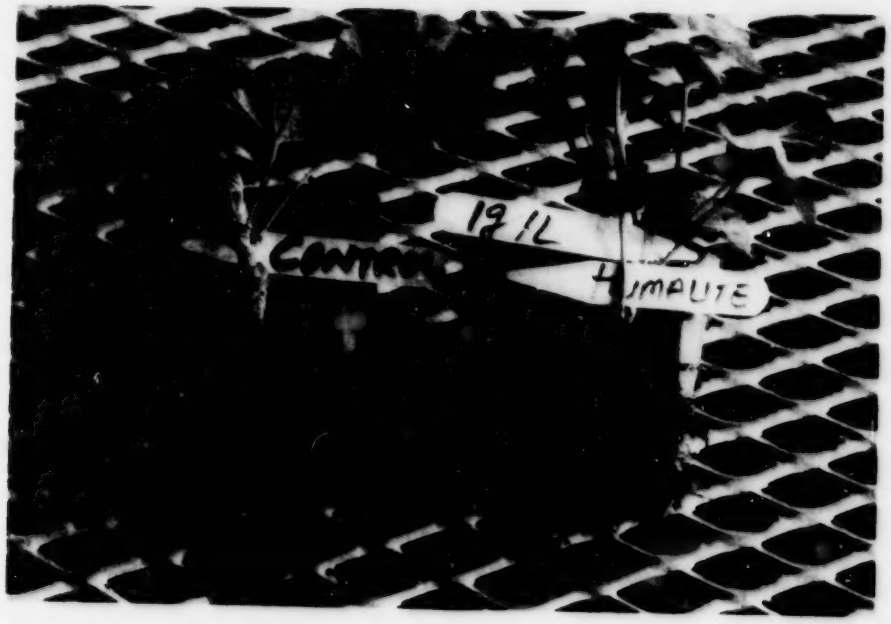


Figure 1. Humate amendments promote better root growth.

Figure 2. Silicon addition in nutrient solution promotes healthy growth.

Micropropagation - **K. Pruski, M. Mirza, S. Pietucha**

The tissue culture laboratory has continued to provide service and support to the industry. The laboratory produced 6,000 saskatoon plants for Alberta Fruit Growers for production and 2,000 plants for various other groups within and outside the province. New cultures of all cultivars have successfully been established for 1990. Requests for saskatoon plants were received from Australia and Scotland and plants will be sent to these countries in the spring of 1990.

The sour cherry selection from the University of Alberta was micropropagated further and a new test orchard of 500 trees was established in Fort Assiniboine. Existing orchards (planted in 1988) at Brooks, Edmonton and Beaverlodge survived winter in excellent condition. Another sour cherry selection from Poland, Lutowka, is now being evaluated for its hardiness in Alberta. About 1,000 trees produced through tissue culture were planted in 3 locations: ASCHRC, Brooks, Alberta Tree Nursery and Horticulture Centre (ATN&HC) in Edmonton, and Beaverlodge. Transplant survival was about 90% and their winter survival will be evaluated in the spring of 1990. There is a strong demand for Lutowka cherry in Saskatchewan and Manitoba. In 1990 survival trials of this cherry will probably be extended to these provinces.

Micropropagation of woody ornamentals was undertaken this year. Purple Leaf Birch was the most successful plant species for micropropagation. The lab developed a micropropagation system for this species and 200 plants were produced. They were planted in several locations to determine their winter survival and suitability to Alberta climate. Micropropagation of oak and green ash proved to be rather difficult, however some progress was made with oak cultures which showed positive response to some cultural techniques. Fern leaf peonies and ivy geraniums showed growth improvement on modified MS media. It required more cytokinin during multiplication stage than previously described. The first plants will be produced in the spring of 1990.

A significant increase in the quantity of micropropagated plants of potato occurred in 1989. A total of 62,000 plantlets were produced from January to August, 1989. New cultures required for 90,000 plants have been prepared for 1990.

The micropropagation of chrysanthemum mutants was highly successful. Three projects were undertaken for Rabb Greenhouses in Strathmore, Alberta. One hundred mother stock plants were delivered to the grower in May 1989 and another 50 in October 1959. In December new cultures of Rabb's chrysanthemum mutants were established and the delivery of mother stock plants is scheduled for April 1990.

Growing interest among growers necessitated the initiation of a new project on micropropagation of pincherry. Two superior selections, Jumping Pound received from ASCHRC and Mary Liss received from Mr. Ted Laidlaw of Native Fruit Nurseries Ltd., Tofield, Alberta (Mr. Laidlaw received this material from Ed Liss, Sangudo, Alberta) were selected for micropropagation.

Cultures of both clones have successfully been established and are now on the multiplication stage. The first 400 plants (200 of each clone) are planned to be produced by the fall of 1990. They will be distributed to Alberta Fruit Growers, the University of Alberta, the University of Saskachewan, the University of British Columbia, Saskatchewan Agriculture and Manitoba Agriculture.

Table I. Plant material produced through tissue culture in 1989.

Plant	Total Number of Plants
Potato	62,000
Purple Leaf Birch	200
Geranium	400
Chrysanthemum	150
Raspberry	200
Saskatoon	8,000
Sour Cherry (U of A)	500
Sour Cherry, Lutowka (Poland)	1,000
Total	72,450

NURSERY CROP DEVELOPMENT

Commodity Report - Brendan Casement

The nursery and landscape industries had a busy year, retail sales of smaller nursery plants were up by almost 25% over the last year, with most of the sales being in the fall.

The Landscape Trades are experiencing difficulty in filling their labour requirements. They admit that they do not have the most desirable working conditions, but with an unemployment rate of 8% and a 25% increase in starting wages over the last year, they felt that they should not have had as much difficulty in filling their needs.

The light frost on May 28, 1989, could have been responsible for the unusual type of growth experienced on many young spruce trees in the nurseries. The terminal buds on these plants failed to develop and in some cases a lateral branch grew much longer than usual. These plants required extra pruning and their sales were delayed for a year. This frost also destroyed the new growth on ash, walnut and oaks, however, the plants reflushed and there was no permanent damage.

Nursery Extension

Four issues of Alberta Nursery Notes were produced, three of which included literature reviews of topics pertinent to the industry. A fourth literature review, on transplanting larger trees, was presented at a Nursery Growers meeting and published in the Prairie Landscape Magazine. Information was provided to about 90 people interested in starting nurseries and to 15 people interested in starting Christmas tree farms. A lecture on overwintering plants growing in containers was presented to the Federal/Provincial Nurserymens meeting in Smoky Lake in September.

The following presentations/lectures were given: "Woody Plants and Perennials for Dry Locations" to the Nursery and Parks Short Course at Regina in February; a lecture on pruning as well as a lecture on "Alternate Trees for Boulevards" at an Ash Bark Beetle Seminar in Calgary. The courses given included two, 2 day pruning courses at the Alberta Tree Nursery and Horticulture Centre (ATN&HC); and two, 1 day propagation courses at the Grande Prairie Regional College.

Four Nursery Growers meetings were attended, 14 nurseries were visited and 4 meetings of the LANTA Research Committee were attended. The Alberta Tree Nursery and Horticulture Centre also hosted the Western Nursery Grower's Tour and Barbecue.

Shelterbelt Extension

Three Fieldmen's meetings were attended, where lectures were presented and discussions were held on the Shelterbelt Program. Six farm visits were made to help plan demonstration shelterbelts or to suggest solutions for shelterbelt problems. Assistance was also provided to Fieldmen who were developing plans for demonstration shelterbelts through the Canada Alberta Soil Conservation Initiative. Brendan Casement was a member of the Cropping and Conservation Task Force and assisted in the preparation of a pamphlet on Shelterbelts for the Canada Alberta Soil Conservation Initiative (CASCI).

Shelterbelt Program - Brian Breneman and Rulie Bok

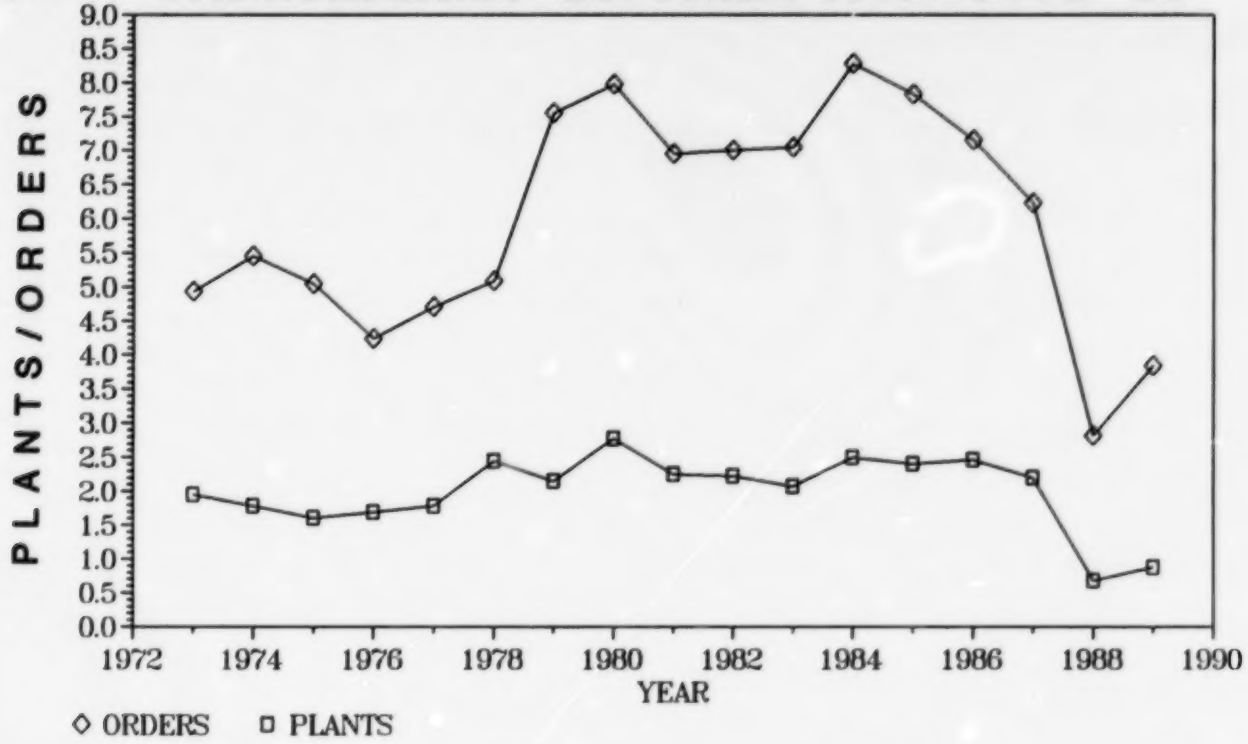
There was a 28% increase in the distribution of shelterbelt material in 1989 over 1988. The charging policy, instituted in 1987, appears to be accepted and the demand for shelterbelt plants will probably increase because of the environmental awareness. Most of the plants distributed in 1989 were started before the charging policy came into effect, therefore grading could be fairly strict.

Table I. Provincial Summary of Shelterbelt Distribution - 1989 - (actual number of plants).

Region	Number of Applications	Tall Deciduous	Small Deciduous	Hedge	Ever-green	Conservation bundles	TOTAL
Lethbridge	799	55,475	7,900	104,825	26,870	143	197,930
Calgary	752	57,450	7,800	113,200	31,710	195	214,060
Red Deer	725	62,575	5,525	41,100	36,910	143	148,970
Vermilion	775	59,350	5,000	43,425	34,440	177	145,755
Barrhead	406	47,100	4,275	19,250	24,890	127	98,055
Fairview	382	27,000	4,900	15,425	12,160	114	61,765
Provincial Total	3,839	308,950	35,400	337,225	166,980	899	866,535

			Total
Arbor Day	Colorado Spruce	37,795	
	Lodgepole Pine	4,230	
	White Spruce	2,200	44,225
Surplus	Sale and special orders	52,865	
	Demonstration shelterbelts	11,375	64,240
4-H Bundles	42 bundles x 20 plants	840	109,305
			975,840

Figure 1. SHELTERBELT DISTRIBUTION 1973–89



Over 50 million young plants have been distributed from the Alberta Tree Nursery and Horticulture Centre for shelterbelts since 1951. A steady increase in the number of applications and plants distributed continues except during 1988 when charging for the shelterbelt plants was instituted. Since then demand has been built back to previous levels and the field windbreak program in conjunction with the conservation initiative has created considerable interest in use of trees.

Production

There were good growing conditions with adequate moisture throughout the 1989 growing season.

During the winter, 1.25 million poplar and willow cuttings were processed and subsequently held in cold storage for planting in early

June. Over 400,000 rooted cuttings were graded out following harvest, with Northwest and Griffin poplars giving unusually poor rooting for the second year in a row.

Assembly of the orders took nine days (between April 28 and May 16) and the orders were picked up by the county offices between April 29 and May 20. A different assembly line system with increased checking of orders was tried in 1989. The new system improved the quality and accuracy of the orders. The lateness and errors in the computer printouts however, caused problems for advisement to the District Agriculturists and Agricultural Fieldmen regarding shipping dates, and the number and size of the shipments for their districts.

Increased emphasis was placed on the replacement of the poplar cutting beds in 1989. All surplus Northwest and Griffin poplar plants and some rooted tip cuttings (5,700 plants) were planted to increase production.

Shelterbelts of Bur oak and Mayday trees were planted in field 14 for future seed sources. This field has been set aside for seed blocks and additional blocks are planned.

During eleven working days in August, 484,000 conifers were transplanted. A total of 14,580 m of seed beds were planted in early summer with green ash and Manitoba maple, and in fall with 24 other species. Caragana was seeded in 6,380 m of beds in 1989, using 107 kg of seed. Two years of trial indicated that the beds yield better than the row seedings.

A killing frost on September 10 allowed for early harvesting which was completed on October 23. (Heavy rain and cold temperatures started on October 24.) Almost one million deciduous plants were graded and stored either in the heeling-in grounds (170,000) or in the freezer storage (820,000).

Container Production - **Cecilia McIsaac**

Over one million seedlings were started in the greenhouses in 1989, consisting of 863,472 conifer seedlings for the Shelterbelt Program, 123,600 seedlings for contract growing, 75,600 seedlings for Arbor Day and 11,712 seedlings for the Parks Program.

Colorado spruce (36,700), lodgepole pine (4,700) and white spruce (2,200) seedlings were provided for Arbor Day activities for grade school students throughout the province.

Material from the Parks Program was sent to the Provincial Parks, Heritage Village, the Oldman River Dam and the University of Athabasca. In total 30,110 plants were distributed of which the Parks requested 7,263 plants. At the end of the year there were 108,000 plants on inventory.

Grounds and Arboreta - **Thean Pheh**

Wood chips have been used in the new arboretum to reduce maintenance as well as to mulch the planting beds in the other arboreta.

A bed in the original arboretum was assigned to the All-American Annual Flower Trial and most of the perennials were moved out. An additional 43 new perennials, trees or conifers were added to the grounds, arboretum or pinetum plantings.

Seed Extraction and Collection - **Doreen Koladich**

The flower buds of many deciduous and coniferous plants were injured during the winter or spring of 1989. Therefore, there were only a few species that produced any amount of fruit. Seeds of spruce and larch were needed but they did not produce seed for the second year in a row. A total of 2,385 kg of fruit or cones were collected yielding 205.4 kg of cleaned seed.

Table II. Seed in Storage, December 1989.

Program	Weight (kg)
Shelterbelt	919
Provincial Parks	30
Private companies	325
Miscellaneous	27
Total	1,301

Contract growers received 30.33 kg of seed of four species and 15 private growers purchased 7.5 kg of seed in 1989.

Chemicals - Doug Lehman

Most of the chemical applications were for weed control, with some insecticides being applied to the greenhouses and as spot treatment on some trees and shrubs. Weather hindered the timely application of some herbicides, but control was generally adequate. Casoron was applied to the poplar cutting beds to reduce competition from weeds and increase production.

Research - Brendan Casement and Thean Pheh

A Fertilizer Trial is in progress for trees and shrubs. Soil and tissue samples were taken for nutrient analysis and height and spread of the trees and shrubs was measured. Bur oak, paper birch and some green ash required replacing because of rodent damage. Some white pine weevil damage was noted on spruce and apple-cedar rust on hawthorn.

The Hardiness Trials were expanded in 1989 with 16 more species. There are now 38 entries, most in the Prairie Regional Trials for Woody

Ornamentals. In 1988, 100 hardwood cuttings of a hybrid willow were purchased from Austree Inc. of California. These rooted well and were 2 m in height at the end of the growing season. However, the tips were killed by the first frost of the fall and growth in the following spring started from just above the ground. Austree Inc. donated five more selections of hybrid willows for evaluation.

An observation trial was initiated in 1989 to evaluate the hardiness and suitability of Dwarfing Rootstocks for apples. There are 23 cultivars being evaluated, including the 'Malling' series.

An All-American Selection Annual Flower Trial was introduced in 1989. In this trial new, unnamed selections are compared to the best comparable cultivars in commerce. In 1989, 19 seedlings were compared to 41 accepted cultivars of bedding plants. The display included 11 award winners and 'hold overs' from past trials. An annual lavender, a deep orange marigold and an orange pansy proved superior in 1989.

Figure 1. Marigolds - All American Annual Flower Trial.

Figure 2. Regional Woody Plant Test Project.

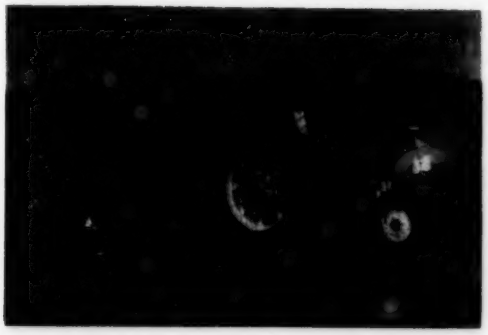


Figure 3. Planting hardwood cuttings.

Table III. Alberta Tree Nursery and Horticulture Centre Weather Report - 1989

Month	Maximum Mean °C	Minimum Mean °C	Mean °C	Extreme High °C	Extreme Low °C
January	-5.2	-15.0	-10.3	8.0	-36.0
February	-9.9	-21.0	-15.5	3.5	-39.0
March	-3.8	-16.9	-10.4	9.0	-34.0
April	11.8	-2.0	4.9	21.5	-13.5
May	17.1	4.5	10.8	27.0	-3.0
June	21.0	9.5	15.3	30.5	4.0
July	23.8	12.2	18.0	29.0	7.5
August	21.0	11.3	16.1	29.0	2.5
September	17.8	4.9	11.4	25.0	-4.0
October	10.9	-0.8	5.1	19.5	-9.5
November	1.9	-6.2	-2.2	11.0	-22.0
December	-3.3	-11.2	-7.3	9.0	-38.0
Average	8.6	-2.6	3.0	30.5	-39.0

Table IV. Precipitation

Month	Rainfall (mm)	Snowfall (cm)	Total (mm)
January	2.8	17.2	20.0
February	--	8.6	8.6
March	0.2	8.8	9.0
April	6.2	4.0	10.2
May	76.4	--	76.4
June	104.0	--	104.0
July	115.0	--	115.0
August	66.1	--	66.1
September	35.6	--	35.6
October	13.8	0.6	14.4
November	8.2	26.0	34.2
December	4.0	10.6	14.6
Total	432.3	75.8	508.1

First and last killing frost dates - May 28 and September 10. One hundred frost free days.

FARM SERVICES SECTION

Farm Services is an integral part of the system at the Alberta Tree Nursery and Horticulture Centre as it provides valuable services to all other programs. In 1989, Farm Services prepared, maintained and irrigated fields; applied 3.3 tonnes of fertilizer and spread 305 tonnes of fill sand and 260 tonnes of manure in the fields; seeded 29.5 hectares of oats for green manure, 8.3 hectares of crested wheat grass and 1 hectare of caragana; mowed headlands and other grassed areas regularly; pruned broken limbs, dead woods, suckers, storm and pest damaged materials from the trees using chain saws; installed frames for plug-ins in the parking lot, repaired fences and replaced a gate; repaired and maintained farm equipment and kept service and maintenance schedules of vehicles on time. Farm Services also performed miscellaneous duties as required.